Medical Xpress

# Immune response to bacteria—distinguishing helpers from harmers

January 10 2018

Some staphylococcus bacteria live peacefully on human skin and membranes in a mutually beneficial relationship with their host, while others are able to exist far from a human host in soil or in water. When we come into contact with bacteria, the activation of our immune system is the first step to fighting off any imminent infection. Just how the immune system distinguishes between potential pathogens and harmless commensal bacteria is the focus of a study by a University of Tübingen team of microbiologists headed by Professor Friedrich Götz.

The researchers found the key in the long-chain fatty acids attached to the bacterial lipoproteins. The length of these fatty acids determines the strength of our immune response. The findings by Professor Götz and his team at the Interfaculty Institute of Microbiology and Infection Medicine are published in the latest *Nature Communications*.

The researchers investigated Staphylococcus aureus, a commensal bacterium on human skin. They compared it with Staphylococcus carnosus, which is often used as a starter culture for production of salami and other meat products. Using a particular receptor, the human immune system recognizes the lipoproteins on the staphylococcus bacteria; these lipoproteins only occur in bacteria and are not produced by the human body. This enables our immune system to identify and respond to invaders from outside the body. "We found that the immune response to Staphylococcus aureus was much less intense than the response to Staphylococcus carnosus," Götz reports.

The researchers identified the differing structures of the bacterial lipoproteins as the main reason for this. In the case of S. aureus, the protein was modified by a long-chain heptadecanoyl fatty acid, while in S. carnosus the chain represented only a short acetyl group. "The difference in structure is comparatively small, yet it has an enormous influence on the immune response," Götz says. The long-chain lipoproteins on S. aureus led to a considerably reduced immune response, both in the innate and the adaptive immune system; while the short-chain lipoproteins on S. carnosus set off an immune response which was almost ten times stronger.

"This confirmed our theory that both pathogenic and commensal bacteria can only survive in a host organism if they can escape or evade the immune system," says Götz. The bacteria have to either silence the immune system or work against it. "The mechanism whereby bacteria use long-chain lipoproteins to avoid an immune response, as the commensal S. aureus does, was previously unknown," Götz explains.

In contrast with the commensal bacteria, there are pathogenic microbes which may cause life-threatening diseases. "This leaves open the old question of why there is no real protective immune response to prevent infection by S. aureus," Götz says. His next step will be to investigate which enzymes and genes are involved in the fatty acid linkage in the S. aureus lipoproteins.

**More information:** Minh-Thu Nguyen et al. Lipid moieties on lipoproteins of commensal and non-commensal staphylococci induce differential immune responses, *Nature Communications* (2017). DOI: 10.1038/s41467-017-02234-4

Provided by Universitaet Tübingen